FACTORS INFLUENCING LOCAL MOVEMENTS OF WOODLAND BIRDS IN WINTER *

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DURING the winter of 1939–40 and 1940–41, I studied the local movements of birds in a forested area along the Sangamon River near Cerro Gordo, Illinois, 40 miles southwest of Champaign.

A map of the area was drawn and copies of it were mimeographed to be taken into the field. The map was drawn roughly to scale and contained various small landmarks by which a bird's location at any

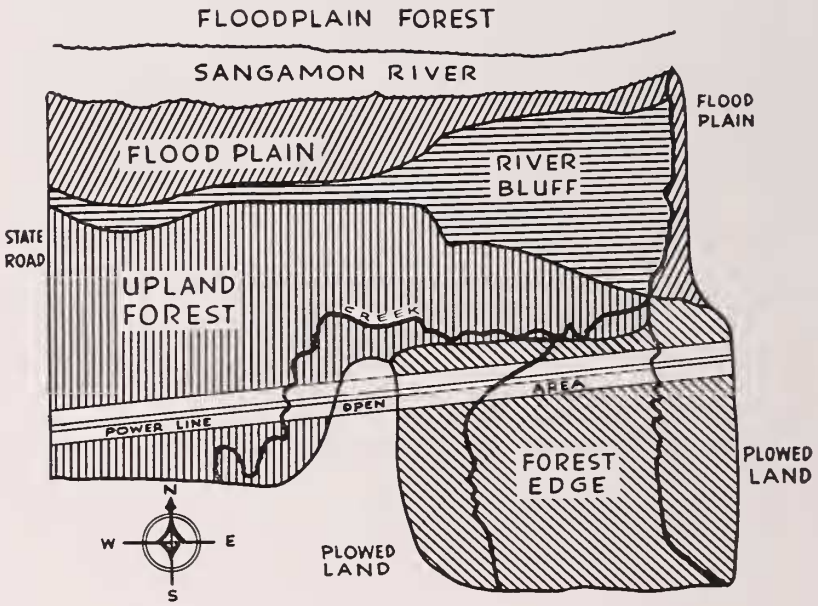

Figure 1. Map of the area studied.

place in the area could be determined. On each trip the distribution of the birds in the area was carefully marked on a copy of the map, and notes were taken of the birds' behavior, flocking, songs, and other points. Trips to the area were made one to two times per week during the winter months.

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I watched particularly the effects of wind, temperature, sun, and precipitation on the distribution of the birds, and on the tendencies of certain species to flock together.

Description of the Area

The area is a second-growth forest, typical of those used by farmers for timber and grazing over much of Illinois. It is composed of 46 acres of four chief habitat types (Figure 1): (1) a floodplain along the Sangamon River (2) a heavily-wooded bluff above the floodplain (3) an upland open forest and (4) a forest-edge. An electric powerline runs diagonally through the upland forest and forest-edge area, leaving an open space of twenty yards width in which the trees have been cut and in which common mullein (*Verbascum thapsus*), coralberry (*Symphoricarpos orbiculatus*), thistle (*Cirsium* sp.), and other sun-loving plants grow. The river bluff, 50 feet high, acts as a windbreak, furnishing protection on its south side from north winds and, likewise, shelter on the low north-exposed floodplain from south winds. The bluff slopes steeply to the floodplain on the north but very gradually to the creek bottom on the south. In the forest-edge area elevation is low along the creeks and higher between them. A brief description of the chief vegetation found in each of the four habitats is here included.

Floodplain:

The dominant trees in the low, wet floodplain are silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), and sycamore (*Platanus occidentalis*). Poison ivy (*Rhus Toxicodendron*) is very abundant, and elderberry (*Sambucus canadensis*), wood nettle (*Laportea canadensis*), and giant ragweed (*Ambrosia trifida*) form dense stands during the summer. This area is ungrazed and is flooded each spring. It is but one part of a floodplain extending down both sides of the Sangamon River.

River Bluff:

The river bluff is fairly moist and is characterized by tall red oak (*Quercus borealis*), sugar maple (*Acer saccharum*), and ironwood (*Ostrya virginiana*), with slippery elm (*Ulmus fulva*) and hackberry (*Celtis occidentalis*) also quite abundant. This is the most heavily-wooded habitat, ungrazed, and the region in which spring flowers are most common. A strong north wind strikes the bluff ridge with tremendous force.

Upland Forest:

The upland forest covers a larger portion of the total area than any other one habitat, is open and dry, is grazed freely, and consists almost entirely of mature white oaks (*Quercus alba*) and shagbark hickories (*Carya ovata*), most of them over forty feet high. Coralberry is profusely scattered over this open forest, forming the chief undergrowth.

Forest-edge:

The forest-edge is a block of the type of vegetation usually found growing as a strip along the edge of a forest. The dominant plants here are hawthorn (*Crataegus* sp.) and hazelnut (*Corylus americana*), with black raspberry (*Rubus occidentalis*), gooseberry (*Ribes gracile*), and osage orange (*Toxylon pomiferum*) well represented. This region contains few trees over thirty feet high, and includes the only dense shrub undergrowth found in the entire area. The forest-edge is surrounded on three sides by plowed fields and is connected with the open forest and floodplain on the fourth side. It is grazed and inhabited by numerous cottontail rabbits.

Winter Population

The winter bird population varied but slightly in composition during the two years, consisting of ten species in 1939–40 and eleven species in 1940–41. The average number of each species present one or both years is listed in Table 1. The larger population for 1940–41 is accounted for chiefly by a flock of Purple Finches which wintered in the area the second year, and by a larger number of Tree Sparrows. During the first winter the Tree Sparrows were usually found along a roadside hedge outside, but this hedge was cut the second year and they moved inside the study area. The absence of Red-headed Woodpeckers and the smaller number of Blue Jays in 1941 may have been caused by the poor acorn crop that year.

The data show 1.1 birds per acre in the winter of 1939–40, and 1.7 birds per acre in 1940–41 (an average of 1.4 birds per acre for two winters). The same birds did not stay in the area all the time. Likewise, some birds recorded on each trip doubtless wandered in from an adjacent territory. It is probable that the population counted in the area during the majority of the winter trips was representative of the actual population. Forbes and Gross (1923) gave a figure of .7 birds per acre in central Illinois in the winter of 1906–7, referring chiefly to open country and not to forests.

TABLE 1
Winter Bird Population

	1939–40	1940–41
Red-bellied Woodpecker (*Centurus carolinus*)	4	2
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	3	0
Hairy Woodpecker (*Dryobates villosus*)	0	1
Downy Woodpecker (*Dryobates pubescens*)	4	5
Blue Jay (*Cyanocitta cristata*)	10	4
Black-capped Chickadee (*Penthestes atricapillus*)	6	7
Tufted Titmouse (*Baeolophus bicolor*)	6	8
White-breasted Nuthatch (*Sitta carolinensis*)	2	3
Cardinal (*Richmondena cardinalis*)	4	8
Purple Finch (*Carpodacus purpureus*)	0	15
Slate-colored Junco (*Junco hyemalis*)	8	12
Tree Sparrow (*Spizella arborea*)	3	12
	50	77

The numbers making up the winter population were arrived at by listing under each date the number of birds of each species counted on that date. Then, going over the numbers listed for all the trips during the winter months, the number which occurred most frequently was taken as the probable population of that species.

Wind

The effect of wind on the local movements of the birds in this area was very striking. It is unfortunate that, because wind was considered a minor aspect of the study when it began, an anemometer was not used, and records of the velocity of the wind were based on my own impressions. The velocities used are as follows: strong means a violent wind; slight means a mild breeze. The contrasting effects of only extreme velocities will be illustrated.

The effect of the wind on distribution is illustrated clearly in Figure 2. The birds included in this figure are winter residents and early spring migrants. The strongest winds and most marked effects on bird distribution occurred in March after the first migrants had appeared. Therefore these maps may be considered as recording distribution in late winter or very early spring. The two diagrams on the left in Figure 2 show the contrasting distribution of the birds on days with slight and with strong winds blowing from the northwest. The slight northwest wind had little effect on the birds, as they were spread all over the area. A strong northwest wind seemed to have caused the species to stay in the sheltered parts away from the blasts, as nearly all of them were on the east side and behind the protecting bluff.

The two diagrams on the right in Figure 2 present a most interesting point. These two maps were made on two consecutive days, March 15 and March 16, 1941. On March 15, a very strong wind was blowing from the south, and every bird in the woodland with the exception of one lone Blue Jay was found on the low, north-exposed floodplain, sheltered from the wind by the high river bluff. The following day the wind did a complete reverse and blew with tremendous force from the north. The floodplain, so well-populated the previous day, was this day deserted, and all the birds were found along the creek bottoms at the base of the south side of the bluff, well sheltered from the north wind's blasts.

The conclusion apparent from a study of these figures is that a slight wind has little or no effect on the distribution of birds in this forest, but a strong wind appears definitely to influence their movements. During this research, I made 39 maps of the distribution of birds during winter days, and they support fully the conclusion here drawn. Carpenter (1935) found that "the 'lee' side with reference to prevailing winds had by far the greatest bird population in all seasons observed," but he did not demonstrate day by day shifts with the changing direction of a strong wind.

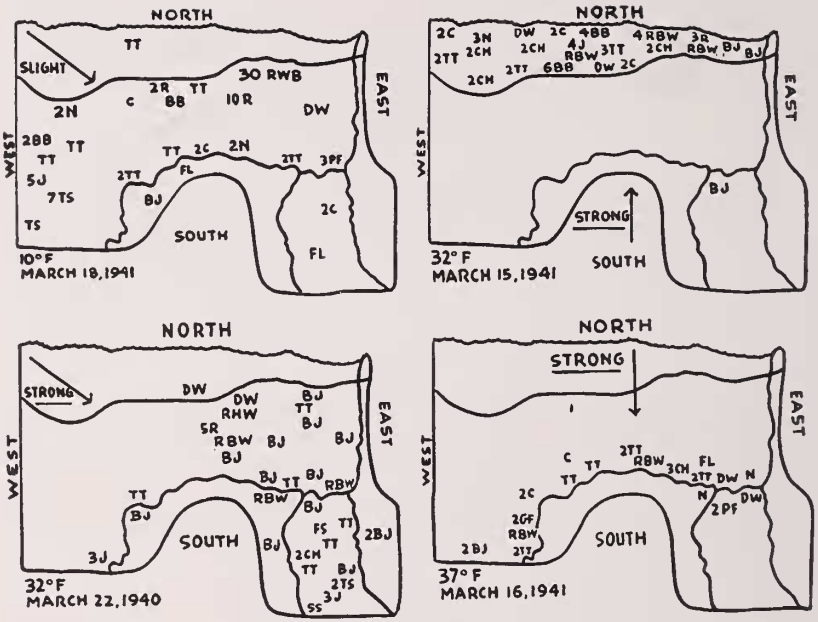

Figure 2. Maps illustrating the comparative effects of slight winds and strong winds on bird distribution. The arrows indicate wind direction.

Symbols:

FL—Flicker	BB—Bluebird
RBW—Red-bellied Woodpecker	RWB—Eastern Red-wing
RHW—Red-headed Woodpecker	C—Cardinal
DW—Downy Woodpecker	PF—Purple Finch
BJ—Blue Jay	GF—Goldfinch
CH—Black-capped Chickadee	J—Junco
TT—Tufted Titmouse	TS—Tree Sparrow
N—White-breasted Nuthatch	FS—Field Sparrow
R—Robin	SS—Song Sparrow

Temperature

The second factor which had an effect on both the activity and the distribution of birds in winter was temperature. Practically without exception, on days when the thermometer registered 25° F. or lower, all birds observed spent their entire time in feeding or hunting for food. When the temperature rose well above 25°, much time was still devoted to feeding, but some was now spent in preening and singing. This was generally true of each species, but especially of Titmice, Chickadees, Nuthatches, and Cardinals.

As an illustration of the effect of temperature on activity, I mention data for January 12, 1941. Cold weather had been constant just before this date, but on the twelfth the temperature was 29° at 7 A.M. and rose

to 58° by twelve noon. Titmice were observed chasing each other; they were scattered over the entire area in two's and three's, and were singing *peto-peto-peto* constantly. Chickadees moved over the area, singing *phoe-be* and answering each other; and a White-breasted Nuthatch was observed flashing the white in its tail feathers. On this warm, sunshiny morning in midwinter, the temperature rose to a spring level, and many of the birds reacted accordingly with spring behavior. A week later, on January 19, the temperature had gone down below 23° and the Titmice, Nuthatches, and Chickadees resumed their winter behavior, feeding constantly and singing little. What else but temperature could have caused such a decided change in activity in midwinter?

The effect of temperature on the social behavior of Titmice, Nuthatches, Chickadees, and Downy Woodpeckers proved interesting. In cold weather, 25° or below, these species tended to flock together and feed in groups. In warmer weather, above 25°, they tended to spread out and scatter over the area. My notes on flocking agree with the conclusion of Wilbur Butts (1931) that "the association of chickadees, nuthatches, and woodpeckers is only a temporary one." None of the many flocks which I watched stayed together for more than an hour. The average number of birds in a flock was ten or eleven, and an average flock consisted of five Titmice, three Chickadees, one Nuthatch, and one Downy Woodpecker. The birds had a tendency to flock early in the morning when the temperature was low and to spread out as the day grew warmer. This leads to the suggestion that flocking may be subject to daily rhythm, varying with the temperature, but this needs confirmation.

In addition, temperature had an apparent influence on the phytovertical occurrence of certain species. To secure food in cold weather, Titmice, Chickadees, Blue Jays, and Cardinals came down to the ground much more frequently than they did in spring, summer, and autumn. This is probably only partially a result of temperature.

Sun and Precipitation

Sun and precipitation are often considered important factors in the winter activity of birds. During the thirty-nine days of my study, the birds seemed to be equally active on sunshiny days and on cloudy days, with or without precipitation.

Summary

A second-growth forest along the Sangamon River in central Illinois consisted of forty-six acres of four chief habitats—(A) a low moist floodplain (B) a high river bluff (C) an open upland forest and (D) a forest-edge.

Trips were made to this area once or twice per week during the winters of 1939–40 and 1940–41. On each trip the distribution of the birds was carefully mapped and notes were taken on their activities.

The average winter population during the two winters was 1.4 birds per acre, and included ten and eleven species respectively.

A strong wind caused birds to seek sheltered areas and changes in the direction of the wind brought about day-by-day movements from one part of the area to another. A slight wind had little or no effect.

Low temperature caused birds to feed almost constantly and to sing little, whereas a rise in temperature decreased feeding and increased singing.

Black-capped Chickadees, Tufted Titmice, Downy Woodpeckers, and White-breasted Nuthatches showed a tendency to form flocks at temperatures below 25° and to scatter when the temperature rose above 25°.

As far as could be determined, sun and precipitation had no effect on the winter activity of birds in this study.

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